

REMARKS

Claims 1-50 are all the claims presently pending in the application. Claims 1, 7, and 46 are amended to more clearly define the invention. Claims 1, 4, 13, 40, and 45-50 are independent. Claims 4-36, 38-41, and 43-50 are allowed.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicant also notes that, notwithstanding any claim amendments herein or later during prosecution, Applicant's intent is to encompass equivalents of all claim elements.

Applicant gratefully acknowledges that claims 4-36, 38-41, and 43-50 are allowed. However, Applicant respectfully submits that all of the claims are allowable.

Applicant gratefully acknowledges that claim 37 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, Applicant respectfully submits that all of the claims are allowable.

Claims 1-3 and 42 stand rejected under 35 U.S.C. § 103(a) over as being unpatentable over the D'Amico, et al. '100 reference, in view of the D'Amico, et al. '593 reference, and further in view of the Gitlits reference and yet further in view of the Barlett et al. reference.

This rejection is respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

An exemplary embodiment of the claimed invention, as defined, for example, by independent claim 1, is directed to an automobile communications method for an on-board mobile station across a plurality of radio zones which are consecutively arranged along a

road. The method includes providing each of the radio zones with a plurality of M communication frequencies, providing N plurality of time slots in one period in each of the radio zones, switching between the M communication frequencies within each of the radio zones using a time division scheme such that a different one of the N time slots is allocated for adjacent radio zones for each of the plurality of M communication frequencies by sequentially assigning at least two of the M communication frequencies to the N plurality of consecutive time slots.

As explained by the present specification, conventional communication systems use a Time Division Multiple Access (TDMA) communication protocol in which different time slots are used at the same frequency. These TDMA systems enable a wide frequency range to be used. However, it is necessary to increase transmission power by an amount which corresponds to the increase in noise to obtain a desired carrier to noise ratio. Additionally, various distortions deteriorate performance. Further, wide-band devices are needed.

By contrast, the present invention provides a novel system having advantages of both Frequency Division Multiple Access (FDMA) and TDMA systems by arranging a plurality of M frequencies in each radio zone and switching these M frequencies in a time division mode within each radio zone and also by switching one of N time slots for each frequency between adjoining radio zones so that individual mobile stations do not have to switch frequencies within a single radio zone.

Rather, each mobile station can communicate continuously using the same frequency within a single radio zone across the plurality of radio zones merely by switching the time slot. In other words, continuous communication is allowed at the same frequency for a mobile station within a single radio zone and the frequency range of each of a plurality of

frequencies is substantially equivalent to that of an existing FDMA system.

Additionally, the present invention has a further advantage in that interference between adjoining zones can be avoided. Each zone communicates using a plurality of M frequencies and switches between these plurality of M frequencies in time division manner which is coordinated with adjoining radio zones so that adjoining radio zones do not communicate simultaneously using the same frequency.

In this case, as long as the same frequency is not selected at the same time between adjoining zones, then time slot positions used in adjoining zones are arbitrarily selected. In other words, it is not necessary to select different time slots between adjoining zones. On the other hand, when a communication frequency is switched, if the same frequency can be selected at the same time between adjoining zones, then different time slots are allocated between adjoining zones.

The present invention provides the above objects and advantages by providing N plurality of time slots in one period in each of the radio zones, switching between the M communication frequencies within each of the radio zones using a time division scheme such that a different one of the N time slots is allocated for adjacent radio zones for each of the plurality of M communication frequencies by sequentially assigning at least two of the M communication frequencies to the N plurality of consecutive time slots.

For example, as shown in Figure 2 of the present specification, "A" period is provided with $N = 12$ time slots and $M = 2$ frequencies. The $M = 2$ frequencies are switched every $N/M = 6$ time slots in each radio zone. In particular, in the odd zone, the first frequency f_{t1}/f_{r1} is used for the first six time slots and the roadside transceiver is switched to the second frequency f_{t2}/f_{r2} for the second six time slots, et. seq.

Similarly, in the even zone, the second frequency f_{t2}/f_{r2} is used for the first six time slots and the roadside transceiver is switched to the first frequency f_{t1}/f_{r1} for the second six time slots. In this manner, continuous communication is provided for the vehicle side transceiver without having to switch frequencies within the vehicle side transceiver while within the same radio zone.

II. THE PRIOR ART REJECTION

The Examiner alleges that the D'Amico et al. '593 reference would have been combined with D'Amico et al. '100 reference and further that the Gitlits reference would have been combined with the combination of the D'Amico et al. '593 reference and the D'Amico et al. '100 reference and goes even further to allege that the Barlett et al. reference would have been combined with the combination of the D'Amico et al. '593 reference, the D'Amico et al. '100 reference and the Gitlits reference to form the claimed invention.

Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

None of the applied references teaches or suggests the features recited by independent claim 1 including a system and method that provides N plurality of time slots in one period in each of the radio zones, switching between the M communication frequencies within each of the radio zones using a time division scheme such that a different one of the N time slots is allocated for adjacent radio zones for each of the plurality of M communication frequencies by sequentially assigning at least two of the M communication frequencies to the N plurality of consecutive time slots.

Further, Applicant respectfully submits that the Examiner has failed to comply with the clear requirements that are set forth in the Manual of Patent Examining Procedure. In particular, the Examiner has failed to comply with the requirements of the M.P.E.P. as set forth in § 707.07(f) by failing to answer all material traversed.

“Where the applicant traverses any rejection, the examiner should, if he or she repeats the rejection, take note of the applicant’s argument and answer the substance of it.” (M.P.E.P. § 707.07(f), emphasis added).

In particular, the Examiner has failed to address the Applicant’s traversals regarding:

1) The claim language recited by independent claim 1 which recites that “communication between the plurality of radio zones and the on-board mobile station is made using a single frequency within at least a single radio zone.”;

2) The frequency hopping that is disclosed by the Gitlits reference requires the mobile station that is using channel 1 to switch frequencies even while communicating with a single radio zone (cell);

3) The frequency hopping that is described at col. 1, lines 47-59 has no effect upon co-channel interference that the Examiner alleges is the motivation to provide frequency hopping;

4) The Gitlits reference clearly requires that a mobile station switch frequencies even while maintaining communication with a single radio zone (frequency hopping) and the Examiner continues to allege that it would have been obvious to modify the teachings of the D’Amico et al. references to require that a mobile station switch frequencies even while maintaining communication with a single radio zone, one of ordinary skill in the art would not have been motivated to modify the Examiner’s alleged combination of the D’Amico et al.

and Gitlits references to now remove the modification that is provided by the Gitlits reference in order to ensure “communication between the plurality of radio zones and the on-board mobile station is made using a single frequency within at least a single radio zone” as recited by, for example, independent claim 1; and

5) The teachings of the Barlett et al. reference by alleging that the Bartlett et al. reference provides a motivation to modify when, to the contrary, the Barlett et al. reference explains that it is irrelevant as to whether a frequency is changed or not. Thus, the Barlett et al. reference does not provide any motivation at all to maintain a frequency or not during the time slot change. Indeed, the Barlett et al. reference very carefully explains that the time slot change can be made “with or without” a change of frequency.

The Examiner has clearly ignored these traversals and Applicant respectfully submits that the Examiner fails to further prosecution of the present application absent addressing these traversals as required by the M.P.E.P.

These traversals are set forth below again in their entirety for the Examiner’s convenience.

Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, the references are directed to completely different and unrelated matters and problems.

As explained previously, one of ordinary skill in the art who was concerned with the problem of the substantial infrastructure investment and complexity that is required when each cell is required to measure and report signal strength to determine whether to hand off a call between cells as the two D’Amico et al. references are concerned with solving would not have referred to the Gitlits reference because the Gitlits reference is directed to the completely

different and unrelated problem of a limited number of frequencies being available in a cluster of cells for performing frequency hopping.

Indeed, neither of the D'Amico et al. references teaches or suggests anything at all related to frequency hopping.

In stark contrast to the D'Amico et al. references and the Gitlits reference, the Barlett et al. reference is directed to the problem of diversity combining of GSM cellular radio signals without incurring the cost of additional/duplicate circuitry (col. 1, lines 28-35).

One of ordinary skill in the art who was concerned with the problem of the substantial infrastructure investment and complexity that is required when each cell is required to measure and report signal strength to determine whether to hand off a call between cells as the two D'Amico et al. references are concerned with solving or who was concerned with the problem of a limited number of frequencies being available in a cluster of cells for performing frequency hopping as the Gitlits reference is concerned with solving, would not have referred to the Barlett et al. reference because the Barlett et al. reference is concerned with the completely different and unrelated problem of diversity combining of GSM cellular radio signals without incurring the cost of additional/duplicate circuitry.

The Examiner admits that the “combination of D'Amico (US 5,127,100) and D'Amico (US 5,159,593) and Gitlits does not specifically disclose communication between the plurality of radio zones and the on-board mobile station is made using a single frequency within at least a single radio zone.” (Emphasis added).

However, the Examiner alleges that the Barlett et al. reference remedies this deficiency.

In particular, the Examiner alleges that the Barlett et al. reference discloses

communication between the plurality of radio zones and the on-board mobile station is made using a single frequency within at least a single radio zone and that “it would have been obvious to one of ordinary skills (sic) in the art at the time of the invention was made to provide the above teaching of Barlett (sic) in the system of D’Amico et al. (US 5,127,100), D’Amico et al. (US 5,159,593) and Gitlits so that the mobile station can handover without a change of frequency (see Barlett, column 4, lines 12-16).

Applicant respectfully submits that one of ordinary skill in the art would not have been motivated to modify the combination of the D’Amico et al. references and the Gitlits reference as alleged by the Examiner.

First, the Examiner continues to be confused about the claim language recited by the independent claims. For example, independent claim 1 recites that “communication between the plurality of radio zones and the on-board mobile station is made using a single frequency within at least a single radio zone.” (Emphasis added).

In other words, the communication channel between the on-board mobile station and each radio zone uses a single frequency and, therefore, the communication channel between the on-board mobile station and each radio zone does not switch frequencies as long as the on-board mobile station is communicating with each particular radio zone.

This feature does not preclude the on-board mobile station from switching frequencies as the on-board mobile station moves from one radio zone to an adjacent radio zone. Rather, this feature requires that the same (single) frequency be maintained as long as the on-board mobile station is communicating with the same (single) radio zone.

As explained above, this feature is important to prevent forcing the on-board mobile station from frequently switching frequencies.

Second, this feature stands in stark contrast to the teachings of the Gitlits reference that the Examiner relies upon for a disclosure of switching the plurality of communications frequencies within each of the radio zones in a time division scheme. The Applicant does not contradict that statement.

Rather, the Applicant agrees that the Gitlits reference discloses switching the frequencies within a radio zone in a time division scheme.

However, not only does the Gitlits reference disclose switching the frequencies of the radio zone in a time division scheme, in stark contrast to the present invention, the Gitlits reference requires that the mobile station also switch frequencies in a time division scheme even while the mobile station maintains communication with the same radio zone.

In particular, the Examiner cites col. 1, lines 47-59 of the Gitlits reference. This portion of the Gitlits reference explains the concept of frequency hopping which is used to reduce the effects of frequency dependent phenomena.

As very clearly explained by the Gitlits reference, frequency hopping relies upon “periodically switching between frequencies during transmission of a particular signal.” (Emphasis added). In other words, each communication channel between any single radio zone and a mobile station is required to periodically switch frequencies.

This concept of frequency hopping is very clearly illustrated by Figures 4A - 5C of the Gitlits reference. In particular, examining Figure 4A of the Gitlits reference very clearly illustrates that communication channel 1 between a particular mobile station and a single radio zone (cell1) is required to switch frequencies from f1 to f2 to f3 to f1, et seq. Therefore, this frequency hopping requires the mobile station that is using channel 1 to switch frequencies even while communicating with a single radio zone (cell).

Third, contrary to the Examiner's allegations, the frequency hopping that is described at col. 1, lines 47-59 has no effect upon co-channel interference that the Examiner alleges is the motivation to provide frequency hopping.

Rather, the Gitlits reference very clearly explains that frequency hopping is useful for reducing the effects of frequency dependent phenomena such as varying propagation conditions for different frequencies (col. 1, lines 47-59).

The Examiner continues to confuse the frequency hopping that is described at col. 1, lines 47-59 in the Gitlits reference which does not reduce co-channel interference with the arrangement of a cellular network "into clusters of adjoining cells, such that the cells in a particular cluster each transmit on different frequencies" (col. 1, lines 34-36) "[i]n order to alleviate the problem of co-channel interference." (Col. 1, lines 33-34).

Therefore, contrary to the Examiner's allegation, one of ordinary skill in the art would not have been motivated to modify the combination of the D'Amico et al. references to include the frequency hopping scheme that is described at col. 1, lines 47-59 of the Gitlits reference "in order to reduce co-channel interference" because the Gitlits reference does not teach or suggest that frequency hopping reduces co-channel interference. Rather, the Gitlits reference teaches that ensuring that adjoining cells transmit on different frequencies reduces co-channel interference (col. 1, lines 33-46).

Fourth, since, as explained above, the Gitlits reference clearly requires that a mobile station switch frequencies even while maintaining communication with a single radio zone (frequency hopping) and the Examiner continues to allege that it would have been obvious to modify the teachings of the D'Amico et al. references to require that a mobile station switch frequencies even while maintaining communication with a single radio zone, one of ordinary

skill in the art would not have been motivated to modify the Examiner's alleged combination of the D'Amico et al. and Gitlits references to now remove the modification that is provided by the Gitlits reference in order to ensure "communication between the plurality of radio zones and the on-board mobile station is made using a single frequency within at least a single radio zone" as recited by, for example, independent claim 1.

The Gitlits reference specifically encourages the use of frequency hopping, which requires switching frequencies by the mobile terminal for any particular signal within each cell, the Gitlits reference actually teaches away from the claimed invention which recites continuously communicating with the on-board mobile terminal on the same frequency within each cell.

In order to frequency hop, each mobile terminal must switch frequencies along with the particular base station that is communicating with that mobile terminal. The Gitlits reference specifically explains that it is advantageous to perform frequency hopping because any one of the frequencies will only be able to adversely affect the particular signal being transmitted between the mobile terminal and the particular base station while that particular frequency is being used and will not adversely affect that particular signal when the particular signal has hopped over to a different frequency (col. 1, lines 53-65).

In stark contrast, the present invention is directed to reducing the burden that is placed on the mobile terminals by not requiring them to switch frequencies at all within a single radio zone.

Rather, the on-board mobile terminals in accordance with the present invention maintain continuous communication even while switching between a plurality of radio zones while only using a single frequency merely by switching time slots.

Therefore, one of ordinary skill in the art would not have been motivated to combine the teachings of the D'Amico et al., the Gitlits and the Barlett et al. references to arrive at the claimed invention.

Further, the Examiner admits that the D'Amico et al. '593 reference, the D'Amico et al. '100 reference and the Gitlits reference does not teach or suggest communication between the plurality of radio zones and the on-board mobile station using a single frequency within a single radio zone.

The Examiner then alleges that it would have been obvious to modify the D'Amico et al. '593 reference, the D'Amico et al. '100 reference and the Gitlits reference to use a single frequency in a single radio zone "so that the mobile station can handover without a change of frequency" and cites col. 4, lines 12-16 of the Barlett et al. reference in an attempt to support that allegation

However, the Examiner clearly mischaracterizes the teachings of the Barlett et al. reference.

The portion of the Barlett et al. reference that the Examiner cites states that "when a call terminates, a RCU on a time slot becomes free . . . In this situation, the controller 20 has the ability to move a call on to that time slot in order to make spare capacity available on a different time slot. This is achieved by intra-cell handover in which the base station instructs the mobile to change its time slot with or without a change of frequency and simultaneously the base station and mobile change to the new time slot (and frequency if necessary)."

(Emphasis added).

In other words, the Barlett et al. reference explains that it is irrelevant as to whether a frequency is changed or not. The Barlett et al. reference does not provide any motivation at

all to maintain a frequency or not during the time slot change. Indeed, the Barlett et al. reference very carefully explains that the time slot change can be made “with or without” a change of frequency.

Therefore, the Examiner clearly mischaracterizes the Barlett et al. reference.

In summary, contrary to the Examiner’s allegations, one of ordinary skill in the art would not have been motivated to combine the references to arrive at the claimed invention.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully submits that claims 1-50, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

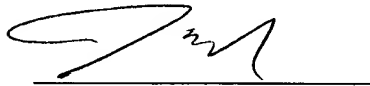
Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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5/25/75



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